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SUSTAINABLE OLIVE OIL GROWING AND PRODUCTION METHODOLOGY HANDBOOK

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Executive summary

This short “Sustainable Olive Oil Growing and Production Methodology Handbook” has a totally applied and practical character, and is mainly aimed at all farmers participating in the ‘OliveOilMedNet’ project. Attempts have been made to deal the project's two main axes: ‘Authenticity of olive oils’ and ‘Sustainability of the culture and production of olive oils from the olive grove to the consumer’.

It begins with a brief history of the olive tree, its cultivation, and olive oils production, with a particular focus on the different typologies of olive groves and production types. Special attention is given to the main and local olive varieties of the countries participating in this project. Emphasis is placed on the physicochemical characteristics of the fruit and olive oils, which can leads us to determine the authenticity of this extraordinary product. It approaches the traceability topics, olive oils and health aspects, and concludes with the marketing of this product and the orientation that consumers must know for its good selection when they pretend to acquire high-quality extra virgin olive oils.

Finally, we wish to highlight that in the elaboration of this Handbook, all partners of the countries included in the ‘OliveOilMedNet’ project have participated, in an intensive and coordinated way.



Chapter 1

The Olive Tree, Olive Oils and their Historical Culture

1.1. Olive tree

The olive tree is not just an agricultural product but a spiritual and cultural cornerstone of Mediterranean identity. It embodies a wide array of values and symbols as peace, fertility, purification, strength, victory, repentance, meanings passed down through generations.

The origin of the olive tree is lost in the mists of time, deeply intertwined with the rise and expansion of the Mediterranean civilizations that shaped the course of human history and left a lasting imprint on Western culture.

Its existence dates back to the twelfth millennium BC. Taking the area that extends from the southern Caucasus to the Iranian plateau and the Mediterranean coasts of Syria and Palestine to be the original home of the olive tree, its cultivation developed considerably in these last two regions, spreading from there to the island of Cyprus. The Phoenicians later played a crucial role in disseminating the olive tree across the Greek islands, eventually introducing it to mainland Greece. In this fertile cultural landscape, olive cultivation gained immense importance and became a defining element of ancient Greek life, both economically and symbolically.

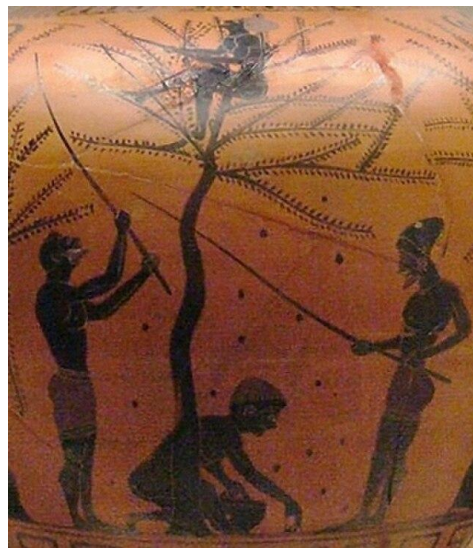


Figure 1. Greek black-figure vase depicting olive harvest (530-510 BC), British Museum.

The olive tree expanded to other Mediterranean regions, including southern Italy. The Romans significantly contributed to the spread of olive cultivation across the Mediterranean basin. They introduced it to new territories such as Gaul, where it reached the city of Marseille, and further encouraged its agricultural and commercial value throughout the Roman Empire.

In the Iberian Peninsula, the olive tree was first brought by the Phoenicians during their maritime dominance. Olive cultivation expanded significantly following Roman influence, and became widespread in what is now modern-day Spain and Portugal. During the Arab occupation of the Iberian Peninsula, new olive varieties and advanced cultivation techniques were introduced, enriching the agricultural knowledge and diversity of the region.

In modern times, the olive tree has transcended its Mediterranean roots. Today, it is cultivated in regions far from its origins, including southern Africa, Australia, Japan, China, and parts of the Americas, symbolizing its global importance and adaptability.



1.2. Olive oils

The olive oil in antiquity was a crucial part of Mediterranean life, played a vital cultural and spiritual role. Its presence permeated all aspects of life, from daily meals to sacred ceremonies. Also, it became indispensable for a wide variety of applications such as tanning, weaving, lighting, perfumery, medicine. Across Mediterranean traditions, olive oil became a sacred symbol of life, purity, and continuity. It marked every important life event symbolizing the divine presence in human transitions.

In ancient Greece, the bond between the olive tree and daily life was profound. Athletes would anoint their bodies with oil before competitions, removing it afterward as part of their ritual. The only prize for victors at the ancient Olympic Games was a wreath made of a wild olive branch—a powerful symbol of honor and glory. Olive oil was also central to religious practices. It was used in offerings on altars, and was believed to have healing properties for various ailments and diseases.

This rich heritage continues to thrive today. In the Orthodox Christian tradition, olive oil continues to hold a central role in ceremonial rites, representing spiritual illumination and divine blessing. In all Mediterranean region, the daily diet remains largely centered on olive oil, often referred to as "liquid gold." Its value is recognised even in areas where olive trees do not grow, underscoring its essential role in health, flavor, and tradition. Beyond its economic importance, olive cultivation fosters community, strengthens social ties, and forms distinct cultural identities. Around the olive grove, generations of knowledge, cooperation, and celebration continue to thrive.

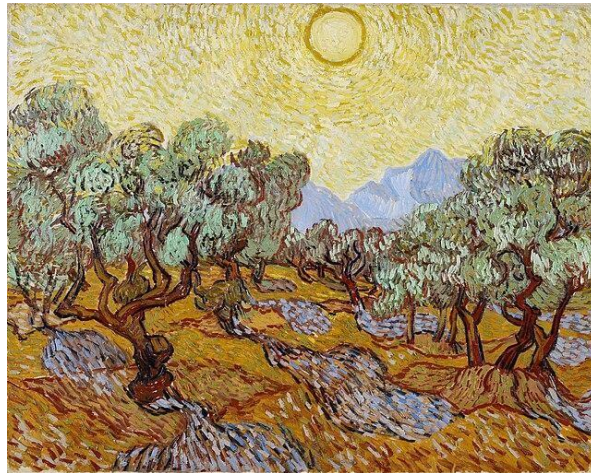


Figure 2. The olive trees (Vincent Van Gogh, 1889).

For millennia, the olive tree has shaped the Mediterranean landscape and deeply informed the daily, social, and spiritual life of its peoples. Its cultural legacy spans the tangible: tools, cultivation techniques, mill architecture, and crafted products; and the intangible: oral traditions, regional cuisines, folklore, and religious observances. The olive tree is a living symbol of Mediterranean heritage, representing not only the land but also the collective memory and identity of its people.

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Chapter 2

Typologies of Olive Groves

Although olive groves can be classified in various ways, the most widely accepted system divides them into three main categories: **traditional**, **intensive**, and **super-intensive** (also known as **hedgerow**).

Traditional groves remain the most common, representing approximately 75% of the global olive growing area. These are primarily rainfed, although irrigation is becoming more prevalent in regions with gentler slopes.

In contrast, intensive and super-intensive plantations count for around 25% of the global olive grove area. The main characteristics of these types of farms are their higher tree density (number of trees per hectare) and the fact that they are usually irrigated, resulting in a significant greater annual yield than traditional systems.

2.1. Traditional olive groves

Traditional olive groves represent the most ancient form of cultivation, often left by our ancestors. Its production depends primarily on the climate and the geographical area. These groves are characterized by a low tree density, **between 80 and 120 per hectare**, and minimal mechanization, meaning that most tasks are usually performed manually requiring significant labor.

Most traditional groves are rainfed, making them particularly vulnerable to climate changes. This results in a marked alternate bearing pattern. Although individual trees may be quite



productive, overall yield per hectare is low due to wide planting distances, typically ranging between 10 and 12 meters.

Depending on the level of mechanization, two main subtypes can be identified:

- **Mechanized Traditional Groves**, found on land with a slope of less than 20% where some of the more costly tasks, such as harvesting or foliar treatments, can be mechanized. These groves can be converted to an intensive by planting new olive trees between the existing ones, increasing the plant density per hectare.
- **Non-mechanizable Traditional Groves**, located on land with slopes exceeding 20%. These groves are not suitable for mechanization due to steep terrain. As a result, the labor-intensive harvest work, which represents the highest cost for the farmer, remains necessary. Changing the planting system is also not possible, due to the unfavorable orography.

In both systems, olive trees take a long time to grow. In fact, optimal yields are only achieved several decades after planting.

Under dry land conditions (non-irrigated), yields average round 1.000 kilos/ha of olives per year, and may double with irrigation.



Traditional olive grove.



2.2. Intensive olive groves

Developed in the 1960s, intensive olive cultivation offers a higher economic return, when compared to the traditional olive groves. This is achieved through **irrigation, mechanized harvesting, and modern orchard designs.**

Trees are typically planted in square or rectangular arrangements such as 7x7 m, 8x4 m, or 7x5 m, resulting in densities of **200 to 600 trees per hectare**. The trees are vase-shaped and pruned to allow efficient harvesting using self-propelled vibrators with collection umbrellas or other mechanical harvesters.

Full production is typically reached in 7 years, although initial harvesting may begin as early as year 5. With proper management, trees in intensive systems can remain productive for over 40 years.

Intensive olive cultivation generates a high yield of extra virgin olive oil per hectare.

Average yields are around **5.000 kg/ha** under rainfed conditions and can exceed **10.000 kg/ha** with irrigation.



Intensive olive grove.



2.3. High density olive groves

This type of olive grove is the most recently implemented and perhaps the one with the greatest future potential. It can be said that for the last 20 years, primarily in Spain and Italy, this new type of olive grove has been increasing, offering a longer productive lifespan compared to super-intensive cultivation. High-density olive groves can have approximately 700 to 1100 trees/ha. The planting density is 2.5 to 3.0 m between trees in the same row, and 4.0 to 5.0 m between rows. This type of grove has significant advantages and is yielding outstanding results. It is worth noting that it allows for the incorporation of varieties that cannot be cultivated in super-intensive systems, such as the 'Picual' variety. High-density groves with the 'Picual' variety already exist in Spain. On the other hand, we have examples of large olive productions in high-density crops and of the 'Favolosa' variety (known as 'FS-17') in the Italian Puglia region where in the 2024/2025 campaign productions close to 20,000 kg olives/ha were achieved in a 19-year-old plantation.

2.4. Super-intensive olive groves (hedgerow)

Super-intensive olive groves are highly mechanized and offers the highest profitability, among all the systems, although the investment required to plant this type of olive groves is much higher than in the previous methods.

The planting density in these groves exceeds 1.000 trees/ha. The most used frames are 2.5 x 1.20 m, 3.5 x 1.35 m, and 4 x 1.5 m, which allows to have up to 3.000 trees/ha.

This system utilizes mechanized pruning and harvesting using adapted grape harvesting machines, which significantly reduce operating costs and labor dependence. It's also common to find automatic irrigation systems with incorporated fertilization. **The high degree of mechanization allows for a rapid entry into production.** Harvesting mechanization is



designed to combine harvesters, which automates the felling, reception, and transportation of the fruit.

Super-intensive rainfed olive groves can produce around 6.000 kg/ha, while irrigated ones can exceed 12.000 kg/ha, provided sufficient water resources are available in the area.

Full production is achieved in just 5 years. However, super-intensive systems have a limited lifespan, typically ranging between 12 and 14 years. This is often due to reduced airflow and light penetration in dense hedgerow designs, which can lead to increased pest pressure, reduced tree vigor, and the eventual need for replanting.



Super-intensive olive grove.

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Chapter 3

Olive Varieties Appropriate for Each Type of Olive Grove and Geographical Area

3.1. Technical soil considerations for growing olive tree

Soil is a key factor in successfully planting olive trees (*Olea europaea* L.). Although olive trees are hardy, each variety responds best under certain conditions. Below are general technical considerations regarding soil, followed by specific details for some common varieties.

3.1.1. General soil requirements

1. Depth:
 - recommended minimum: 80–100 cm
 - ideal: >1.2 m
 - avoid shallow soils (<50 cm)
2. Texture:
 - optimal: loam, sandy loam, or light clay loam
 - avoid: heavy clays (poor drainage) and very poor sands without organic matter
3. Drainage:
 - essential: does not tolerate waterlogging
 - sensitive to root asphyxia
 - gentle slopes (2–10%) favor drainage
4. pH:
 - optimal: 6.5–8.0
 - tolerates up to 8.5
 - sensitive to very acidic soils (<5.5)
5. Limestone: good overall tolerance. Frequent problem: iron chlorosis in soils with high



active limestone (>10–15%)

6. Organic matter: ideal: 1.5–3%. Improves structure and water retention.
7. Salinity: moderately tolerant. Recommended electrical conductivity: <4 dS/m

3.1.2. Soil requirements according to variety

1. ‘Picual’

- highly adaptable
- tolerates calcareous soils
- withstands some salinity
- prefers deep soils
- suitable for rainfed cultivation

2. ‘Arbequina’

- prefers loamy or sandy loam soils
- sensitive to waterlogging
- sensitive to salinity
- widely used in super-intensive systems

3. ‘Hojiblanca’

- good adaptation to calcareous soils
- medium textures
- sensitive to excess moisture

4. ‘Frantoio’

- prefers fertile, well-structured soils
- sensitive to salinity



3.1.3. Common soil problems in olive groves

Problem	Consequence	Solution
Waterlogging	Root asphyxia	Drainage, subsoiling
Compaction	Poor root development	Deep subsoiling
Ferric chlorosis	Yellowing	Application of chelates
Low organic matter	Poor growth	Organic inputs
Salinity	Lower production	Washing and improved drainage

3.1.4. Soil analysis prior to growing

Soil analysis prior to planting any variety should include the following parameters:

- texture
- pH
- active lime
- electrical conductivity
- organic matter
- phosphorus and potassium
- cation exchange capacity (CEC)

3.2. Climatic considerations for growing olive trees

3.2.1. General climate requirements

1. Temperature:
 - optimal annual average: 15–20 °C
 - tolerates >40 °C with adequate humidity.
 - cold damage:
 - 5 °C → slight
 - 7 to –10 °C → moderate
 - < –12 °C → severe



2. Chill hours: required for flowering: 200–600 hours $< 7^{\circ}\text{C}$ (depending on variety).
3. Light: high demand for solar radiation.
4. Precipitation: optimum for rainfed must be in a range of 400–600 mm/year but can produce with 300 mm well distributed. In the other hand, the olive grove will have problems in very humid climates (>800 mm).
5. Ambient humidity: excessive humidity promotes powdery mildew and tuberculosis and dry climates reduce disease.
6. Wind: strong winds during flowering reduce fruit set.

3.2.2. Climate adaptation by variety

Variety	Cold	Drought	Extreme heat	Humidity
‘Picual’	Medium	High	High	Medium
‘Arbequina’	Low–Medium	Medium	Medium	Medium
‘Hojiblanca’	Medium	High	High	Medium
‘Frantoio’	Medium	Medium	Medium	Medium

3.2.3. Main characteristics

- ‘Picual’: good adaptation to continental and semi-arid climates.
- ‘Arbequina’: more sensitive to frost; excellent in intensive irrigation.
- ‘Hojiblanca’: good drought tolerance.
- ‘Frantoio’: best in classic Mediterranean climates.

3.3. Olive varieties according to cultivation system: typology of olive groves

The olive tree is an adaptable species, but each variety responds better to certain cultivation systems. In general, there are two main types.



3.3.1. Varieties appropriate for traditional and intensive cultivation

These two types of cultivation are characterized by deep soils, lower planting density, limited irrigation, or dry conditions. The varieties best adapted to these types of planting are those shown in the table below, which are well suited to less fertile soils and manual management.

Variety	Main characteristics	Adaptation
‘Picual’	Highly rustic, tolerant to drought and limestone, good resistance to moderate cold	Rainfed, continental/semi-arid climate
‘Hojiblanca’	Moderate resistance to cold, good tolerance to drought	Rainfed and moderate irrigation
‘Kalamata’	Tolerates some cold climate	Mediterranean rainfed, mild climates

3.3.2. Varieties appropriate for high-density and super-intensive cultivation

High density or super-intensive cultivation is characterized by the need for frequent irrigation, mechanized pruning, and the selection of compact, high-yielding varieties. The varieties listed in the table above stand out for their manageable vigor, early production, and ease of mechanization.

Variety	Main characteristics	Adaptation
‘Arbequina’	Compact vigor, high productivity, sensitive to frost and salinity	Mild climate, intensive irrigation
‘Picual’ (intensive)	Productive, vigor controllable with pruning	Irrigated, medium-high density
‘Frantoio’	Good adaptation to irrigation, medium vigor, sensitive to extreme drought	Irrigated, Mediterranean climate
‘Koroneki’	Very high oil yield	Irrigated, mild Mediterranean climate



In summary, it is important to highlight that traditional varieties can withstand water stress and less fertile soils, whereas intensive varieties require fertile soil, good drainage, and access to irrigation. The choice must take into account climate, risk of frost, salinity, and possibilities for mechanization.

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Chapter 4

Types of Sustainable Olive Oil Production

4.1. Context

Environmental conservation in olive groves is closely linked to the production of high-quality virgin olive oils. In our olive-growing regions, this task has yet to be developed. The production of virgin olive oils begins in the tree itself and is partially completed in the oil mill's cellar.

Currently, four types of olive production are distinguished: traditional, integrated, organic, and biodynamic. Within the context of the 'OliveOilMedNet' project, and considering best agricultural practices for the near future, traditional or conventional production would not be considered a sustainable methodology.

4.2. Integrated production

Integrated Production is based on a more sustainable and rational form of agricultural production, based on the optimal use of inputs (fossil fuels, phytosanitary products, veterinary medicines, feed and fertilizers), which are replaced, whenever possible, by sustainable practices and technologies that are more respectful of the environment (biological control, organic fertilizers, use of treatment thresholds...). In short, it is the agricultural system for producing fruits and vegetables that optimizes resources and mechanisms, ensuring long-term sustainable agriculture. Integrated production is a concept that originated in Spain, specifically in Andalusia, and is not only applied to olive groves but also to other types of agricultural crops.



For the cultivation of olive groves, the Specific Regulation governing agricultural practices was approved by Order of 18 July 2002 (BOJA No. 88, 27 July 2002). Subsequently, the Specific Regulation on Integrated Production in Andalusia for industries producing olive oil was approved by Order of 24 October 2003 (BOJA No. 217, 11 November 2003), and the Specific Regulation on Integrated Production in Andalusia for industries producing table olives by Order of 16 June 2004 (BOJA No. 123, 24 June 2004). This completes the regulations required to cover the entire production process for olive oils and table olives.

In the Integrated Production Regulations, each of the aspects to be fulfilled are specified according to:

- Mandatory practices
- Prohibited practices
- Best practices



I n t e g r a t e d
P r o d u c t i o n i n
A n d a l u s i a
(S p a i n)
C o m p a n y :
M o n v a S . L .



4.3. Organic production

Organic production is a system of agri-food management and production that combines the best environmental practices with a high level of biodiversity and preservation of natural resources, as well as the application of high animal welfare standards, with the aim of obtaining a production in accordance with the preferences of certain consumers for products obtained from natural substances and processes.

Organic Agriculture defines an agricultural system whose fundamental objective is to obtain food of the highest quality, respecting the environment and preserving the fertility of the soil, through the optimal use of natural resources, excluding the use of synthetic chemical products and ensuring sustainable agricultural and livestock development.

Conversion of olive groves to organic production:

- To obtain official certification of organic production, the producer must inform the responsible authority, registering with an authorised certification agency.
- In order to trade the product with the organic label, a transition period must be respected.
- To convert an olive grove to organic, a maximum of 3 years must pass in compliance with the requirements of the Law (Regulation (EEC) No. 2092/91): it is forbidden to apply any product not authorized by the control authority, not to irrigate with waste or contaminated water and to follow the conversion plan authorized by the control agency. On plots where they can demonstrate compliance with these conditions, they may request a reduction of the conversion period, once authorized by the competent authority.



**O r g a n i c
P r o d u c t i o n .
F a r m e r
J u a n G . P u e n t e s
(J a e n , S p a i n)**

4.4. Biodynamic production

In biodynamic agriculture, farms are considered complex organisms, emphasizing the interrelationship between soil, plants, and animals: a system in balance, avoiding external interventions as much as possible and taking into account, among other things, the loss of nutrients due to harvesting. The plot is an ecological entity containing interdependent organisms. Emphasis is placed on integrating crops and livestock, nutrient recycling, soil maintenance, and the health and well-being of crops and animals, with farmers and ranchers also being part of the whole.

Obviously, the use of synthetic fertilizers, pesticides, and herbicides is not permit. Furthermore, it differs from other models by using plant and mineral preparations as compost additives and soil sprays, known as biodynamic preparations, as well as following a culture calendar based on the movement of the stars.



In Spain, product certification and obtaining the Biodynamic trademark are the responsibility of the private international “Demeter” group. For biodynamic products to be certified and subsequently marketed, since the term “bio” is included in the trademark, official certification is required for organic products.

Regarding official regulations affecting the use of biodynamic preparations, it is necessary to comply with the “Regulation on animal by-products not intended for human consumption (SANDACH)”. This includes Regulation (EC) No 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation 1774/2002 (SANDACH Regulation).

In order to obtain biodynamic production certification, farmers must take into account a series of practices in addition to organic farming standards:

- The entire operation (including fields and animals) must comply with the “Demeter” protocol.
- The presence of cows or other ruminants on the farm is necessary to produce compost and maintain the vegetation cover.

4.5. Conclusion

In the 'OliveOilMedNet' Project, our recommendation from a sustainability and economic profitability point of view is integrated and organic production with a perspective of at least 10 years.

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Chapter 5

Elaboration Processes of Olive Oils. Innovations in the Last Years

5.1. Introduction

Initially, it should be noted that the production of virgin olive oils begins in the tree itself and is partially completed in the oil mill's cellar. In recent years, and from the perspective of the production of early harvest virgin olive oils, it is worth highlighting the introduction of cold technology in preliminary external and internal operations and in the preparatory stages of olive pastes, fundamentally in the malaxation operation. Recently, new technologies have been introduced to replace or reduce the malaxation stage: thermomechanical extruder ('Protoreattore'), paste treatment by electric pulses, and use of high-power ultrasounds.

The future of the olive oil industry must move towards a greater interrelation between olive oil production, conservation of the environment and energy generation (Sánchez et al. 2024).

5.2. External preliminary operations

- a) **Harvest season:** start of campaign (1st week of November).
- b) **Transport:** daily collection (preferably in plastic boxes), transported to the oil mill the same day.
- c) **Reception at the oil mill:** recommended in stainless steel hopper and well cleaned.



5.3. Internal preliminary operations

- a) **Classification:** separate ground and flight. In the selected line, only flight olives will be used. It will be necessary to separate by variety
- b) **Storage:** not advisable since extraction must be carried out immediately upon receipt or, in the most unfavorable case, on the same day of receipt.
- c) **Cleaning:** this is a crucial stage, as the aim is to remove as much impurities and dirt as possible from the fruit. In short, everything that could be leaves, branches and other elements that could affect the quality of the final product.
- d) **Washing:** only recommended on the ground.
- e) **Sampling:** for each sample, the moisture and volatile matter content (HMF, %) and total fat content are determined in duplicate, both on a wet basis (HMF, %) and on a dry basis (HMF %).
- f) **Weighing of the fruit.**

5.4. Preparation of olive pastes

5.4.1. Grinding

To separate the oil, which is stored in the olives in the form of tiny droplets in the vacuoles of the fruit's mesocarp, these tissues must be destroyed by grinding the olives: OLIVE PASTES. Where possible, a different mill should be used to the hammer mill. If this is not possible, a hammer mill with lower rotation speed 3000 rpm. Under the most favorable conditions it should be 1500-2000 rpm, double sieve and cooled.

5.4.2. Dilacerated

The action of increasing the dilaceration in the mill is always positive in relation to increasing the differentiation of the oils obtained. This action is intended for the parts not sufficiently treated with the mill. In hammer mills with double sieve, or in mills with grooved cylinders that go at a lower rotation speed, the dilaceration achieved at this stage is greater.



5.4.3. Malaxation

Key stage to obtain quality oil with adequate yields. Its objective is to gather the oil drops dispersed in the paste in a continuous oily phase: conditions of greatest possible contact between the oil drops (avoiding emulsions that impede extraction). In short, to achieve a good separation of the different phases. The parameters to be controlled are:

- * Temperature < 25°C.
- * Blending time, 60 minutes
- * Rotation speed of the blades (if possible, set this speed to 15 rpm).

At higher temperatures and times, there is an increase in the reaction rate of all the exchange and degradation processes of the labile components responsible for the fresh and harmonious fruity aromas: heated, cooked or burnt flavors appear, and depending on the preparation time, they can also be detected as an aromatic background and aftertaste, the sensation of wood, pomace or *alpechin*.

To increase extraction yields and the extractability index, high-purity, small-particle-size microtalc should be used during the malaxation stage. This addition of microtalc to the oil production process increases the content of total phenolic compounds, tocopherols, and pigments (chlorophylls and carotenoids).

5.5. Extraction process

5.5.1. Solid-Liquid separation (S-L)

Centrifugation processes: due to density differences between solid, aqueous and oily phases, Fig. 5.1.

2-outlet decanter: most commonly used in Andalusia (>95%).

- Disadvantage with respect to 3 Outputs: high humidity of the pomace obtained.

- Advantages: it can produce oils with a higher content of phenolic compounds.

The oily phase output then passes through a vibrating sieve to separate solid particles. This sieve and the tank below must be perfectly clean.

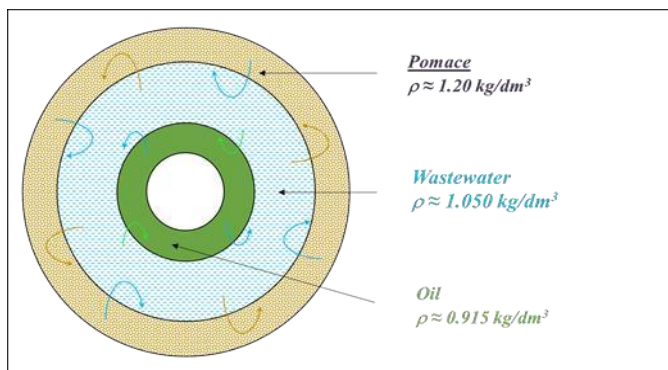


Fig. 5.1. Formation of the three centrifuge rings in the two- and three-outlet decanter.

5.5.2. Liquid-Liquid separation (L-L)

Vertical centrifuge:

- Based on the same principle of centrifugation.
- This equipment consists of a self-cleaning device to remove residues of solid suspension (sludge) accumulated inside.
- In this equipment, precise control of the added water and its temperature, as well as the oil and its temperature.
- At the entrance of the vertical centrifuge, ratios close to 2/3 oil and 1/3 water should be used.
- The temperature of the added water must be 2°C above the temperature of the oil that is also coming in.

5.6. Downstream operations

5.6.1. Clarification

Not recommended



5.6.2. Filtration

This stage is intended to free the oil from any possible traces of moisture, as well as particles or impurities. It is also a very important stage, prior to the storage of the oils and therefore it must be ensured that there are no particles or moisture content that could affect the quality of the oil (physically, chemically and sensorially). It is carried out through press filters using cellulose plates that will be frequently replaced in order to ensure the correct development of the process. The oils must be filtered immediately after they leave the vertical centrifuge or, in the most unfavorable case, within 12 hours of leaving the vertical centrifuge.

5.6.3. Storage

Once classified in its corresponding tanks, the oil is left to settle naturally for a few days, after which all the oil is filtered, in order to avoid the purging of tanks, which is not perfect, and thus prevent possible humidity and impurities decanted from having a negative effect on its evolution during the rest of the year. However, in some cases, purges are carried out in order to ensure at all times that the oil is free of any type of humidity, sludge or impurity, guaranteeing its quality. Likewise, it is advisable to carry out a purification process.

Inertisation: the oxygen in the headspace of the tanks (air) is replaced by an inert gas, nitrogen (N_2), in order to prevent possible oxidation by the oxygen present in the air. Where possible, the oils produced in the selected extraction line must be taken to tanks that can be rendered inert.

In the tanks corresponding to the selected operating line, differentiated by variety and type of production, sampling will be carried out for the physical-chemical and sensory characterization of the extracted oils. Sampling will be carried out at least every 2 days.

5.6.4 Sensory evaluation of the samples extracted

Oil samples intended for sensory evaluation and physical-chemical characterization (packaged



in opaque colored bottles, if possible, in glass) must be frozen at -18°C until determined.

- Sensory characterisation will be carried out from October 15, 2024.
- Prior to sensory evaluation, samples must be filtered with syrup paper.
- Physical-chemical characterisation of the oil extracted (100 cm³ is needed for each sample). Quality parameters: (Acidity degree, Peroxide index, Ultraviolet absorption K₂₇₀, K₂₃₂ and ΔK), Pigment content (Chlorophylls and Carotenoids), Total phenolic compounds content, Determination of sterols, Uvaol and erythrodil content, Determination of tocopherols, Fatty acid profile, Parameter K₂₂₅, Ethyl esters and Oxidative stability (IOC 2021).

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Chapter 6

Authentication of Olive Oils: New Characterisation Methodologies

6.1. Introduction

The global market for olive oil is experiencing increased demand, along with growing concern over product authenticity and quality. Fraudulent practices such as mislabeling, dilution with cheaper oils, and misrepresentation of geographic origin threaten consumer trust and fair competition. Authentication of olive oil ensures that products meet labeling claims in terms of origin, variety, production method, and purity. With advances in analytical techniques, new methodologies are now enabling more precise and rapid characterization.

6.2. Why authentication matters

- **Consumer Protection:** ensures that buyers receive what is claimed on the label (e.g., “Extra Virgin” or PDO-certified oil).
- **Market Integrity:** prevents adulteration with low-grade oils (e.g., sunflower or soybean oil) and misrepresentation of origin.
- **Legal Compliance:** meets regulatory standards such as those enforced by the **EU**, **FDA**, **IOC**, and national authorities.
- **Traceability:** allows verification of geographical and varietal identity (e.g., Greek ‘Koroneiki’ vs Italian ‘Frantoio’).



6.3. Types of olive oil fraud

Authentication targets several common fraudulent practices, including:

- **Adulteration with other vegetable oils** (e.g., hazelnut, palm, or canola oil).
- **Mislabeling the grade** (e.g., “virgin” sold as “extra virgin”).
- **Blending with lower-quality or old olive oils.**
- **False claims of Protected Designation of Origin (PDO) or organic certification.**

6.4. Traditional quality control methods

Regulatory bodies and producers use a combination of **physicochemical** and **organoleptic** (sensory) tests to ensure authenticity:

- **Free fatty acid content** (measures degradation).
- **Peroxide value** (indicates oxidation).
- **UV absorbance (K_{232} , K_{270})** (detects rancidity and adulteration).
- **Panel test (sensory evaluation)** for flavor defects.

While these methods are essential, they can be subjective or limited in detecting certain types of fraud.

6.5. New and emerging characterization methodologies

Thanks to developments in analytical chemistry, biotechnology, and data science, several advanced methods are now available for olive oil authentication:

A. Chromatographic Techniques

1. Gas Chromatography (GC) and Liquid Chromatography (LC):
 - Separates fatty acids, sterols, and phenolic compounds.
 - Helps detect blends or unusual profiles.



2. High-Performance Liquid Chromatography (HPLC):
 - Used to analyze phenolic content and tocopherols (vitamin E), key for varietal characterization.
3. GC-MS (Gas Chromatography–Mass Spectrometry):
 - Identifies and quantify volatile compounds.
 - Used for aroma profiling and detection of adulterants.

B. Spectroscopic Techniques

1. Nuclear Magnetic Resonance (NMR):
 - Non-destructive techniques are used to profile lipid structure.
 - Offers rapid geographic and varietal fingerprinting.
2. Fourier-Transform Infrared Spectroscopy (FTIR):
 - Fast and cost-effective.
 - Detects adulteration and compositional changes without chemicals.
3. Near-Infrared Spectroscopy (NIR):
 - Allows on-site, real-time analysis.
 - Suitable for quality screening and moisture/oil content estimation.

C. DNA-Based Methods (Molecular Markers)

- PCR-based DNA analysis can verify olive cultivar identity from trace DNA in oil.
- Useful for origin authentication and confirming varietal purity.
- Limitation: DNA degrades during oil extraction; requires sensitive protocols.

D. Isotopic and Elemental Analysis

- Stable isotope ratio analysis (e.g., $^{13}\text{C}/^{12}\text{C}$, $^2\text{H}/^1\text{H}$, $^{18}\text{O}/^{16}\text{O}$): differentiates oils by geographic origin based on natural isotopic signatures.
- Trace element analysis (e.g., Sr, Ba, Fe): helps establish a “geochemical fingerprint” of the olive’s growing region.



E. Chemometrics and Machine Learning

- Advanced statistical tools and AI (e.g., PCA, LDA, SVM, Random Forests) are applied to analyse complex data sets from GC, NIR, NMR, ...
- Helps in classification, prediction, and fraud detection.
- Enables rapid screening of large sample batches with high accuracy.

6.6. Regulatory and standardization efforts

- The **International Olive Council (IOC)** provides baseline standards for oil quality and recommended analytical techniques.
- The **European Union** mandates traceability systems for PDO/PGI products and encourages adoption of scientific authentication tools.
- National agencies (e.g., FDA, EFSA) are expanding lab capacity to detect fraud using high-throughput methods.

6.7. Challenges and outlook

- **Cost and complexity** of advanced techniques may limit adoption by small producers.
- **Need for harmonized databases** of authentic reference oils by region and variety.
- **Integration of portable tools** (handheld NIR or biosensors) is a growing trend.

As the olive oil market continues to grow, robust and innovative authentication methods are essential for ensuring **quality, fairness, and sustainability** across the value chain.



6.8. Summary table: techniques briefly

Method	Purpose	Strength
GC / HPLC	Fatty acids, sterols, phenols	High chemical resolution
NMR / FTIR / NIR	Rapid profiling	Fast and non-destructive
DNA Testing	Cultivar / varietal verification	Genetic accuracy
Isotopic/Elemental	Geographic traceability	Environmental signature
Chemometrics / AI	Pattern recognition	High predictive power



Chapter 7

Traceability in Fruits and Olive Oils

7.1. Concept and framework of traceability

Traceability in olive groves and olive oil is a comprehensive process that spans from olive cultivation to the end consumer. Its proper implementation requires accurate records, control at every stage of the process, and commitment from all agents in the value chain. Identifying critical points minimizes risks, ensures oil quality, and reinforces transparency and competitiveness in the olive oil subsector.

It is also a fundamental element in the olive oil value chain, as it guarantees food safety, product quality, and transparency for consumers. It is also important to highlight the importance of proper document management and process control to prevent risks, fraud, and quality losses.

Therefore, traceability ensures transparency and regulatory compliance, preventing fraud and guaranteeing that the olive oil reaches the market in the right conditions. This system not only complies with legal requirements, but also improves the competitiveness of producers and consumer confidence. This chapter analyzes traceability in the olive oil subsector, detailing its importance, the key stages of the value chain, and the critical points that must be controlled at each stage.

Traceability is defined as the ability to track the movement of food through the stages of production, processing, and distribution. In the agri-food sector, there are three types:



1. Backward traceability, which allows the origin of raw materials to be identified.
2. Internal traceability, which controls the processes within each operator.
3. Forward traceability, which allows the destination of the final product to be known.

The correct integration of these three levels is essential to ensure the effectiveness of the traceability system in the olive oil subsector.

7.2. Traceability in the olive oil production value chain

7.2.1. Olive production in the olive grove

Traceability begins on the olive grove, where data relating to olive cultivation is recorded, such as:

- Identification of the producer and the plots
- Varieties grown
- Agricultural practices and phytosanitary treatments
- Date and method of harvesting

and the critical points at this first stage are:

1. Inappropriate or unregistered use of phytosanitary products
2. Mixing of olives from different plots or varieties
3. Late harvesting that negatively affects the quality of the fruit

7.2.2. Transport of olives to the oil mill

Transport of olives is a key stage in preserving product quality, so the aspects to be controlled should be:

- Identification of the batches transported
- Hygiene and sanitary conditions of transport
- Time elapsed between harvesting and milling

and the critical points at this stage are:

1. Prolonged delays that cause fermentation processes



2. Lack of separation between batches
3. Use of unsuitable containers

7.2.3. Reception and processing at the oil mill

At this stage, the olives are processed into olive oil. The controlled aspects at the oil mill are:

- Recording of olive deliveries by batch and separation of olives according to quality
- Cleaning, grinding, and extraction processes
- Classification of olive oil according to quality

and the critical points are:

1. Mixing of olives from different origins or in different sanitary conditions
2. Deficiencies in the cleaning of machinery, it must be cleaned every day after grinding
3. Errors in the allocation of batches of resulting olive oil

7.2.4. Storage of olive oil

The olive oil obtained must be stored in tanks until it is bottled or sold. The controlled aspects at this stage are:

- Identification of tanks and batches
- Storage conditions (temperature, light and oxygen)
- Transfer records

and the critical points are:

1. Oxidation of olive oil due to inadequate conditions
2. Cross-contamination between batches
3. Lack of documentary control of movements

7.2.5. Packaging of the olive oil

Packaging is the final stage of processing before distribution and the controlled aspects taking care in this stage are:

- Batches used in packaging
- Packaging date and batch number



- Labeling in accordance with current regulations

Therefore, the critical aspects are:

1. Incorrect or incomplete labeling
2. Loss of the link between the packaged oil and its origin
3. Risk of fraud in the commercial category of the oil

7.2.6. Distribution and marketing

Distribution connects the product with the end consumer. The controlled aspects are:

- Registration of customers and destinations
- Distributed batches and delivery dates

and the critical aspects are:

1. Break in the documentary traceability chain
2. Inadequate storage conditions at points of sale: temperature and excessive light
3. Difficulty in recalling products in the event of a food alert

7.3. Importance of identifying critical points

The identification of all these critical points in olive oil traceability allows us to:

- Guarantee food safety for the end consumer
- Maintain product quality
- Facilitate crisis management and market recalls
- Prevent fraud and protect consumers

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Chapter 8

Sustainable Use of By-Products and Waste Minimization Olive Oil Sub-sector

The olive oil subsector plays a crucial role in the agricultural economy of Mediterranean countries and beyond. However, olive oil production generates significant by-products and waste, which if not managed properly can pose environmental challenges. A sustainable approach to by-product utilization and waste minimization can transform environmental liabilities into economic and ecological assets.

8.1. Understanding olive oil by-products and waste

During the mechanical extraction of olive oil, several types of residues are produced. The main by-products include:

- Olive pomace (solid residue): a mixture of crushed olive skins, pulp, and pits left after oil extraction.
- Olive mill wastewater (OMWW): liquid effluent rich in organic matter, polyphenols, and suspended solids.
- Leaves and twigs: removed during the cleaning process prior to milling.

8.2. Environmental concerns from conventional disposal

Traditional disposal methods (such as dumping OMWW in fields or burning pomace) have led to:

- Soil and water contamination



- Air pollution
- Odor nuisance and greenhouse gas emissions

8.3. Valorisation of olive oil by-products

Modern olive mills are adopting circular economy principles, with pathways such as:

- Energy production (biomass fuel and biogas)
- Composting and soil amendments
- Extraction of polyphenols and antioxidants
- Use as animal feed (after treatment)

8.4. Innovative technologies for waste minimization

- Two/three-phase decanter systems
- Membrane filtration and advanced oxidation
- Pelletizing systems for dried pomace
- Digital monitoring for efficiency

8.5. Best practices for sustainable management

- Segregate waste streams
- Minimize water use
- Partner with local farmers and facilities
- Comply with environmental laws
- Pursue eco-certifications (ISO, EMAS)



8.6. Conclusion

The sustainable use of by-products in the olive oil industry is essential for environmental protection, economic efficiency, and long-term competitiveness. Through innovation and collaboration, the sector can turn waste into wealth and support a circular agri-food system.





Chapter 9

Olive Oils and Healthy Aspects

9.1. Introduction

Botanically, the olive is a drupe composed of three main parts: peel (epicarp), pulp (mesocarp), and stone (endocarp). Nutritional compounds are unevenly distributed among these parts, with the pulp containing the majority of lipids. The chemical composition of the olive, and consequently of the oil obtained from it, is strongly influenced by varietal, environmental, and agronomic factors. These factors determine the fruit's shape, color, and lipid content, as well as the profile of minor compounds, including sterols, phenolic compounds, and tocopherols, responsible for its nutraceutical properties.

9.2. Olive oils

Olive oil is composed primarily of triglycerides (approximately 98-99%), predominately monounsaturated oleic acid, with concentrations ranging from 55 to 83%. Oil quality is closely linked to the ratio of oleic acid to linoleic acid, with optimal values associated with high oxidative stability and improved shelf life of the final product. The unsaponifiable fraction of the oil (approximately 1-2%) consists of bioactive compounds such as phytosterols (especially β -sitosterol), squalene, tocopherols (vitamin E), and polyphenols, which exert protective effects against oxidative stress, dyslipidemia, and inflammatory processes. The polyphenolic profile of extra virgin olive oil is particularly influenced by the cultivar, the state of ripeness of the olives, and the extraction method.



The fatty acid content of oil also varies depending on agronomic practices. Water availability, for example, influences the percentage of linolenic acid; while pruning and fertilization techniques can alter the lipid composition. Excess nitrogen is known to reduce the synthesis of phenolic compounds, compromising the nutritional quality of the oil.

9.3. Table olives

In addition to oil, olives can be consumed whole and are known as "table olives." Unlike other fruits consumed fresh, they require specific technological treatments to eliminate the bitter component provided by oleuropein, making the product edible without excessively altering its nutritional value. The transformation processes involve natural lactic fermentations or brine treatments, which partially modify the fruit's phenolic and sugar profile. With ripening, in fact, the concentration of simple sugars (D-glucose and D-mannose) decreases, while that of oleic acid increases, making the olive richer in monounsaturated lipids. Furthermore, table olives are a good source of dietary fiber (2-3 g/100 g), calcium, iron, and sodium (the latter varies greatly depending on the brine). Lipids represent approximately 10-15% of the fresh weight, of which oleic acid is the main constituent.

9.4. Healthy aspects

A distinctive characteristic of table olives is their high content of phenolic compounds, particularly hydroxytyrosol and tyrosol. Although some is lost during processing, properly treated olives retain significant antioxidant activity. EFSA has further confirmed the role of hydroxytyrosol in protecting LDL from oxidation, starting with a minimum intake of 5 mg per day through olive oil. This recommendation, not yet applied to table olives, opens up possibilities for nutraceutical valorization for this product as well, especially if minimally processed.



Olive oil, obtained by mechanically pressing the fruit of the olive tree, is distinguished from other vegetable oils by the absence of chemical refining processes and the presence of a rich unsaponifiable fraction. Its lipid composition is dominated by monounsaturated fatty acids, with oleic acid being the main constituent (up to 78% of total lipids), followed by linoleic acid (PUFA) and palmitic acid (SFA). This composition makes it particularly stable to oxidation and suitable for both raw and cooked use, with a generally higher smoke point than many other vegetable oils. The oleic acid content is considered a quality parameter: oils with percentages above 70% are considered more valuable.

The unsaponifiable fraction, although representing less than 1.5% of the oil, is responsible for most of its nutraceutical and sensory properties. It contains tocopherols (vitamin E), squalene, sterols, chlorophyll pigments, and carotenoids, as well as over 230 different phenolic compounds. The latter include secoiridoids (oleuropein and derivatives) and lignans, which possess anti-inflammatory and antiatherogenic properties.

From a nutritional standpoint, extra virgin olive oil represents a functional food par excellence. The presence of phenolic compounds contributes to protection from oxidative stress, while tocopherols participate in the protection of membrane lipids from reactive oxygen species. Squalene, in addition to acting as a precursor in cholesterol biosynthesis, exhibits antitumor and photoprotective activity in animal models. Furthermore, recent studies confirm the protective activity of oleocanthal, a phenolic compound specific to extra virgin olive oil, in modulating cellular mechanisms involved in chronic inflammation and neuroprotection. Oleocanthal is absent in refined oils, highlighting the importance of extraction technologies in preserving minor compounds.

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Chapter 10

Olive Oils, Gastronomy and Oleotourism

Olive oil, often called “liquid gold,” is a cornerstone of Mediterranean culture and cuisine. More than just an ingredient, it represents tradition, health, and identity. It is a basic element of the Mediterranean Diet not only for its flavor, but also for its multiple health benefits, while also promoting longevity. Nowadays the use of olive oil is no longer limited to areas where the olive tree is grown and it has come to represent quality cooking almost all over the world.

10.1. Olive oil in gastronomy

The olive oil is known internationally in the field of gastronomy and it has become one of the gourmet star products of Mediterranean cuisine grace in its distinctive flavor and exceptional nutritional properties. Many restaurants now offer tasting menus that showcase different olive oil varieties, pairing them with artisanal bread, local cheeses, and seasonal vegetables. Each olive oil, depending on its origin and extraction method, carries unique aromas (fruity, floral, robust, or peppery) transforming a simple dish into a sensory experience. Whether drizzled over fresh salads or enriching cooked meals, extra virgin olive oil elevates flavors while contributing to a healthy diet rich in antioxidants and monounsaturated fats.

10.2. Oleotourism

The marketing of olive oil as a gastronomic product in relation with the cultural wealth of the Mediterranean, shaped by olive trees and olive oil, has given rise to oleotourism. Therefore, oleotourism is a form of experiential and sustainable tourism celebrating the excellence of extra



virgin olive oil through tourist and leisure activities dedicated to the discovery and cultural enjoyment of the olive tree, the olive oil and the olive-oil producing areas.



Oleotourism is more than just an activity, it is an experience that highlights the product's health benefits, the cultural importance, the historical roots, and the environmentally friendly production. Likewise, on oleotourism the tourists can receive an unforgettable gastronomic experience:

- Appreciate the landscape of the olive grove.
- Visit oil mills, which is where olive oil is manufactured either by traditional means or using the new olive press technologies. The visit thus becomes an event where the tasting of the oil plays a fundamental role and where the tourist can appreciate its different flavors.
- Visit olive museums, where the different techniques of oil manufacturing are shown, as well as its evolution within the culture of each place.
- Taste the dishes of the area, in which one of the fundamental ingredients is olive oil, served in local restaurants.

Oleotourism is not only an economic opportunity but also a means of preserving heritage, promoting sustainability, and embracing modern trends in tourism. As oleotourism expands, it creates jobs in hospitality, gastronomy, and artisanal production, reinforcing rural economies and social resilience. The growth of oleotourism also supports conservation efforts. Olive



groves play an essential role in soil preservation, biodiversity protection, and preventing desertification. Sustainable farming practices amplify these benefits, making olive oil tourism appealing to environmentally conscious travelers.

The pillars of European oleotourism are founded on six essential elements that together define its identity and success.



- ✓ **Oil culture** lies at the heart of oleotourism, as the traditions, architectural heritage of oil mills, festivals, folklore, and cultivation techniques all reflect the unique character of each territory.
- ✓ **Tourism** itself is a key driver, with the quality of infrastructure, hospitality services, and complementary activities determining the attractiveness and viability of the destination.
- ✓ Equally vital is the **territory**, where the landscape of olive groves—shaped by both natural and urban environments—creates a distinctive setting often tied to Protected Designations of Origin (PDOs).
- ✓ **Sustainability** ensures that natural, cultural, and economic resources are managed responsibly, preserving them for future generations while delivering tangible benefits to local communities.
- ✓ **Authenticity** is another cornerstone, offering visitors genuine experiences that stand in contrast to mass tourism and fostering a deeper connection with the local way of life.



- ✓ Finally, **competitiveness** is achieved by continuously adapting products, services, and production systems to evolving market demands, all while maintaining sustainable practices.

Olive oil, gastronomy, and oleotourism form a powerful trio, inviting people to discover flavors, history, and landscapes through a product deeply rooted in Mediterranean heritage. It is not just food, it is culture, wellness, and an enduring journey.

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Chapter 11

Marketing of Olive Oils

11.1. Context and challenges

The Mediterranean olive oil sector is rich and diverse, encompassing producers of all sizes and from various terroirs. Faced with increasing competition in both local and international markets, a well-crafted marketing strategy has become essential to enhance the value of olive oils and ensure the economic sustainability of the sector. This approach must be applicable across all Mediterranean regions involved in the project, while remaining adaptable to each context (production volume, quality labels, distribution networks, commercial maturity, etc.).

Effective marketing will highlight the authenticity and quality of Mediterranean olive oils, two key attributes that strongly influence consumer purchase decisions. The objective of this guide is to provide a concise, practical overview of the essential steps and tools required to build such a marketing strategy.





11.2. Market analysis and segmentation

Every strategy begins with a thorough market analysis. This involves gathering data on demand (consumption trends, growth patterns), supply (existing offerings, competitors' positioning), and consumer habits (purchase criteria, regional preferences). Such analysis helps identify opportunities and threats in the market, as well as internal strengths and weaknesses.

Based on this, a market segmentation can be developed by grouping consumers into categories with similar expectations. For the olive oil sector, relevant segmentation criteria include:

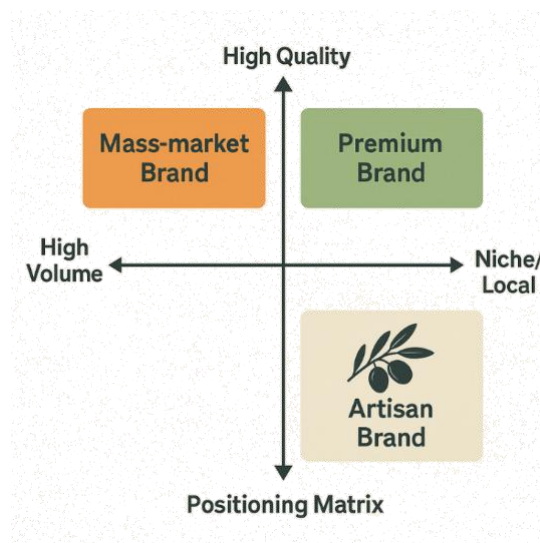
- Consumer profile: e.g., households vs. professionals (chefs, food industry), or gastronomic tourists interested in local products.
- Product quality: extra virgin, organic, certified geographical indications, etc.
- Distribution channels: short circuits (farm sales, local cooperatives) vs. long circuits (mass retail, export, e-commerce).
- Cultural/geographical habits: traditional users vs. newly emerging markets.

This segmentation helps identify attractive target segments those whose needs most closely align with what the product offers and that represent a strong value potential. Once identified, the targeting phase consists of selecting the most promising segments to prioritize for marketing efforts.

11.3. Positioning and differentiation

After selecting target segments, the next step is to define a clear positioning, how you want the olive oil to be perceived by consumers relative to competitors. Positioning reflects the product's distinctive advantage, such as high sensory quality, a prestigious geographic origin, environmentally friendly production, or excellent value for money.

Effective positioning is supported by product and brand differentiation, including the promotion of official certifications (PDO, PGI, organic), which are trust indicators. Building a strong brand identity is key through a compelling brand name, logo, label design, and above all, a strong narrative (storytelling) about the product's origin and method of production.



11.4. Marketing strategy and operational mix

With the positioning defined, a coherent marketing strategy can be developed using the classic “4 Ps” framework:

- **Product:** tailor the product to consumer expectations, choose varieties with specific flavor profiles, ensure high quality (e.g., low acidity, cold-pressed), and invest in attractive, functional packaging.
- **Price:** set pricing aligned with your positioning. A premium product can command a higher price if supported by storytelling and certification; a broader audience may require more competitive pricing.
- **Place (Distribution):** select appropriate sales channels, from direct-to-consumer (farm gate, local markets, e-commerce) to partnerships with fine food retailers or



mass distribution. Logistics, volume capacity, and consistency are key.

- **Promotion:** develop a communication strategy tailored to your audience. This can include point-of-sale tastings, trade show participation, digital marketing (social media, e-commerce), content creation (blogs, videos), and even participation in international competitions to gain awards and visibility.

Consistency across these four pillars ensures a strong, distinctive market presence and maximizes added value throughout the olive oil supply chain.

The Oil Olive Med Net project relies on a representative selection of Mediterranean varieties, each offering unique organoleptic and nutritional characteristics.

11.4.1. Adapting to local contexts

Although these principles are broadly applicable, the strategy must be adapted to local conditions:

- **Production scale:** small-scale producers should focus on direct sales, storytelling, and artisanal positioning. Larger cooperatives may pursue export contracts, standardization, and diversified branding.
- **Certification availability:** territories with PDO/PGI or organic labels can rely on them as marketing assets. Others must emphasize sensory quality, transparency, and sustainability certifications.
- **Distribution capacity:** proximity to tourist areas or urban centers enables short supply chains; remote areas may need to rely on structured distribution partnerships or online platforms.
- **Commercial maturity:** territories new to marketing can begin with basic branding and training. Mature regions may explore innovation and diversify into cosmetics, oleotourism, or experiential offerings.

Sharing marketing experiences within a transnational network like OliveOilMedNet can



accelerate learning and build collective intelligence. Tools and campaigns can be co-designed, events co-hosted, and digital platforms shared, increasing the visibility and competitiveness of all involved producers.

11.5. Conclusion

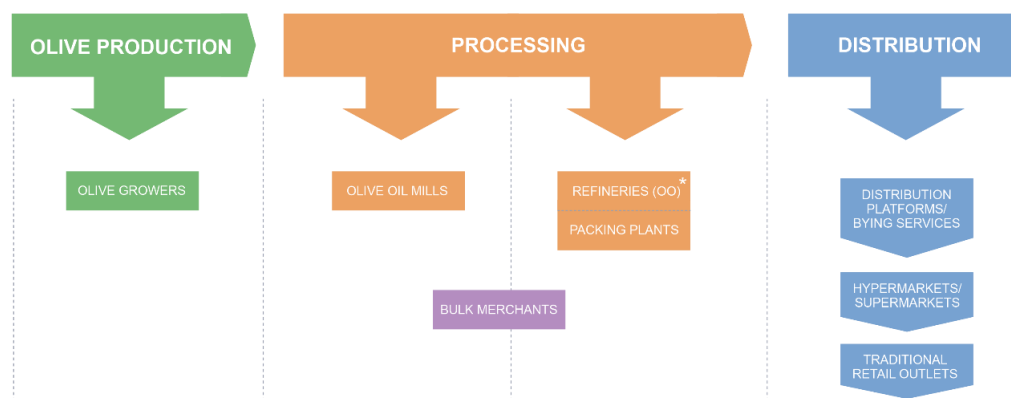
An effective olive oil marketing strategy involves more than just selling a product. It's about crafting a story, building a brand, and creating lasting connections with diverse consumer groups. By understanding market dynamics, defining a distinctive positioning, and executing a coherent marketing mix, producers across the Mediterranean can successfully elevate the profile of their oils.

This methodology provides a common foundation for action while allowing flexibility to reflect local realities. Through cooperation and knowledge sharing, Mediterranean olive oil producers can collectively reinforce the identity, value, and sustainability of their oils in global markets.

Chapter 12

Value Chain in the Production of Olive Oils

The olive oil value chain comprises three main interconnected stages involving highly specialized players. These stages: Olive production, processing and distribution of olive oil, collectively determine product quality, competitiveness, and profitability.



General structure and description of the value chain, Food Price Observatory MARM, Spain 2010 (*For olive oil that is not virgin or extra virgin grade).

12.1. Olive production

The value chain begins at the agricultural level with olive farming, where production techniques directly influence oil attributes. Olive growers are farmers, who may work on their own or in business associations. The activities in the production are critical: soil management, irrigation, pruning, fertilisation/fertigation, plant health treatment.



Harvesting follows. The chosen harvesting strategy (whether manual or mechanical) affects not only efficiency but also the oil's acidity and flavor. Timely transport to the mill is crucial to prevent fermentation and preserve quality.

In recent years, the need to develop farming models combining agricultural practices with environmental conservation practices has led to rapid growth of alternatives to conventional forms of olive production such as organic olive growing and integrated olive production.

12.2. Processing

In this stage, innovation and technology add critical value. The goal is to extract high-quality extra virgin olive oil with minimal oxidation.

This stage involves activities at oil mills: Fruit reception, classification, cleaning and/or washing, oil extraction: crushing, malaxation and extraction, usually through cold pressing or centrifugation, classification and quality control, oil storage, Quality management, environmental management and traceability.

The oil may be packed straight away if it is virgin grade, or it may be sold to refineries which produce refined olive oil. In packing there are activities as pack manufacturing, filling, sealing, labelling and packaging, palletisation, quality management / environmental management and traceability, transportation to distribution platform.

Design, material (dark glass or tin), and labeling not only preserve the oil's quality but also influence consumer preference. Sustainable packaging solutions are increasingly important for environmentally conscious markets.

Quality control measures, including lab testing and sensory analysis, are key to achieving extra



virgin classification.

12.3. Distribution

The olive oil enters distribution channels, moving through wholesalers, retailers, or directly to consumers via online platforms. The activities in distribution stage are: reception and storage at the distribution platform, management, reparation orders and dispatch of orders, transportation to store, shelf placement, product replenishment, spoilage and expiry control, in-store sales.

Branding and market positioning play a strategic role. High-end producers may focus on traceable, small-batch oils for gourmet markets, while others target larger volumes at competitive prices. Traceability, origin labels (like PDO/PGI), and certifications (e.g., organic or fair trade) also add value.

In conclusion, the olive oil value chain is a complex and dynamic system that integrates agricultural tradition, technological innovation, environmental responsibility, and market responsiveness. From the cultivation of olive trees to the final delivery of bottled oil to consumers, each stage in the chain adds distinct value that influences the overall quality, identity, and economic potential of the product.

A well-functioning olive oil value chain contributes significantly to rural livelihoods, regional development, and cultural preservation. It provides employment opportunities across multiple sectors—from farming and processing to logistics, retail, and tourism—and fosters resilience in local economies, particularly in Mediterranean countries where olive cultivation is deeply rooted in tradition.

The olive oil value chain is not merely a sequence of technical steps, but a strategic framework for sustainable value creation, capable of delivering high-quality products, supporting rural



economies, and aligning with the values of today's conscious consumers.

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